Standardization Leadership in Broadband Wireless

Visiting Committee on Advanced Technology
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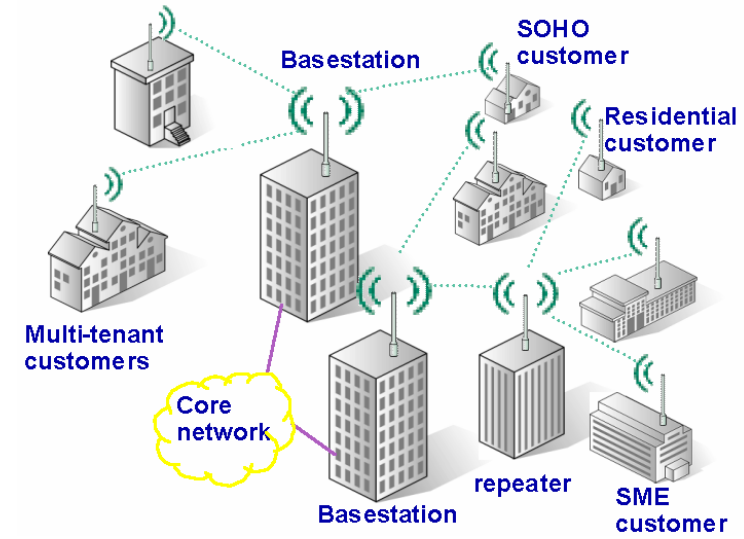
Outline

- Broadband Wireless Access: applications
- Historical Review of NIST Activities in Broadband Wireless Standardization
- IEEE 802.16 Working Group
  - Wireless Metropolitan Area Networks ("WirelessMAN")
- Internationalization and World Trade
- Impact of NIST Activities
- Department of Commerce Interactions
- Future Directions

Broadband Access for Buildings

- The "Last Mile"
  - –Fast local connection to network
- Business and residential customers demand it
  - –Data
  - –Voice
  - –Video distribution
  - –Real-time videoconferencing
  - –etc.
- Network operators demand it
- High-capacity cable/fiber to every user is expensive
  - –Construction costs do not follow Moore's Law

WirelessMAN: Wireless Metropolitan Area Network



Source: Nokia Networks

Goals of this effort

- **Help make wireless become the third major leg of broadband access in America**
  - In addition to cable-modem and DSL networks.
  - Expand access; address underserved areas.
  - Standards are required for wide-scale deployment.
- **Help make Broadband Wireless Access electronics an important U.S. export product**
  - Standards can be a non-tariff barrier to world trade.
  - European effort had been the major activity.
  - The result is a unified world standard in which U.S. participants have had a strong voice.

Startup History

- **In 1998, NIST initiated standardization of broadband wireless access.**
  - "National Wireless Electronics Systems Testbed" (N-WEST)
  - supported by Acting NIST Director Robert Hebner (Five-Year "Competence" funding)
  - started web site and newsletter in April 1998
  - industry strategy session at NIST in July 1998
  - first meeting in August 1998 (45 people)
  - "members are universally praising NIST officials for pushing standards efforts through the testbed"
    - *EE Times* cover story, 17 August 1998
  - Reported to VCAT on September 1, 1998

Flashback: VCAT Presentation of 1998

N-WEST:
The
National Wireless Electronic Systems Testbed

September 1, 1998

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NIST

Flashback

N-WEST is:

- a coordinated project of NIST and the National Telecommunications & Information Administration (NTIA)
- an experiment in how the U.S. Department of Commerce can promote the commercialization of new wireless frontiers
- a pro-active effort to accelerate development of the broadband wireless industry by encouraging voluntary standards
- an effective use of NIST's "convening power" to create an industry standardization effort
- a new way of doing business: applying NIST measurements to help forge industry consensus standards and specifications
- a measurement testbed at the Boulder Labs of NIST & NTIA
- closely tied to industry (advice, equipment, personnel, . . .)
- on the Web at http://nwest.nist.gov
- open to your suggestions

Flashback

Wireless Standards in the United States

- FCC no longer regulates standards for wireless communications (spectrum auctions since 1994)
- no coordinated U.S. approach to wireless standardization
- standardization in newly-auctioned spectrum is slow
- multiple standards continue indefinitely
- equipment costs remain high
- U.S. equipment manufacturers handicapped internationally
- for new services, licensees and vendors may hesitate
- EU is aggressively forging and promoting standards
- What is the U.S. response?

Flashback

N-WEST Philosophy

Achieving the Goal:

Accelerated Commercialization

Through:

- equipment cost reduction (esp. at customer end)
  - mass production
    - standardization
      - voluntary industry standards bodies
        - unbiased measurement support

VCAT Comments: 1998

"The Committee was impressed with the degree of industry involvement in this effort and its effectiveness. We think this general approach might be applied to industry standards needs in other industries, and we urge NIST to seek more opportunities to clone this strategy."

–1998 VCAT Annual Report

What Happened Since 1998?

- Pursued the strategy
- Sought N-WEST funding
  - has not come
  - in the meantime, continued with standardization
- Initiated open industry standardization activity
- Elected to lead that activity
- Drove process to completion of core standards
- Continuing to lead process
  - Enhanced standards
  - Conformance test documents
- An industry is blossoming around the standards

History Since Startup

November 1998:

- Held N-WEST meeting with IEEE 802 standardization
- IEEE 802 chartered a Study Group to analyze problem

March 1999:

- IEEE 802 initiated **IEEE 802.16 Working Group on Broadband Wireless Access Standards** (Marks elected Chair)
- Began meeting every two months (inc. 8-11 Sept 2003 in Denver)

2001:

- first two standards completed

2003:

- four more standards completed; four more begun
- interoperability consortium (WiMAX) becomes very active
- major industry award (from WCA)
- extensive press coverage

2001-2003:efforts at global adoption

Role of NIST Staff as Chair

- "WCA Individual Governmental Vision Award" (14 Jan 2003)
  - Wireless Communications Association International (WCA)
    - trade association for wireless broadband communications
  - "longstanding efforts in promoting ***standards*** for broadband wireless as a way ***to increase interoperability and otherwise lower costs to enable widespread deployments***."
  - "***New technologies cannot readily achieve commercial success without standard specifications***. This can be an exhaustive process, requiring the highest level of ***vision, technical knowledge, leadership skill and dedication***."
  - "***It reflects so well upon you and NIST within the Department of Commerce that these efforts have provided a beacon - both for deploying broadband within the U.S. and also for bolstering exports of what is primarily a U.S.-developed technology***."
- [Regarding a problem in the development of WiFi standards:] *The only remedy is to speed up the standards process for Wi-Fi as the IEEE has succeeded in doing for WiMAX.*
  - *Wireless Watch*, 7 August 2003

Wall St. Journal

"A new wireless technology that could one day be used to deliver high-speed Internet access to homes and businesses received the support of several high-profile technology companies… to help certify equipment based on a new wireless technical standard that could help greatly expand the availability of high-speed Internet access… **802.16** technology has a range of as much as 31 miles… '**We believe it's the next big thing in the wireless broadband arena**,' said Margaret LaBrecque, president of the WiMAX group.

Wall St. Journal, 9 April 2003

Forbes Magazine

"A little-known standard called Wi-Fi turned into the hottest technology of the year and shook the wireless industry to its core. Now its successors hope to leave Wi-Fi in the dust... This new standard is dubbed 802.16a… 'The ultimate vision is wireless broadband everywhere,' enthuses Sriram Viswanathan, who oversees wireless investments at Intel's venture capital arm. 'It could potentially be the biggest thing since the Internet itself.'"

"Wider-Fi," *Forbes*, 14 April 2003

[feature article on 802.16]

IEEE 802 Standardization

- Part of IEEE Standards Association
  - ANSI accredited
  - IEEE (Institute of Electrical and Electronics Engineers) is world's largest technical professional society
- Global
- Open
- Industry-Driven
- The clear authority on networks

IEEE 802 Standards

Wired:

- 802.3 (Ethernet)

Wireless:

- 802.11: Wireless LAN (Wi-Fi)
  - Local Area Networks
- 802.15: Wireless PAN (inc. Bluetooth)
  - Personal Area Networks
- 802.16: WirelessMAN™
  - Metropolitan Area Networks

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IEEE 802.16 Working Group on Broadband Wireless Access

Wireless Metropolitan Area Networks

http://WirelessMAN.org

57 Members (peaked at 178)

>900 different individuals have attended a session from 23 countries

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Countries of IEEE 802.16 Members (current and former)

- BELGIUM (1)
- CANADA (50)
- CHINA (1)
- FINLAND (4)
- FRANCE (2)
- GERMANY (3)
- ISRAEL (22)
- ITALY (1)
- JAPAN (3)
- KOREA (6)
- SPAIN (1)
- TAIWAN (1)
- UK (12)
- USA (172)

Current IEEE 802.16 Activity

- **Conformance documentation**
  - testing to ensure interoperability
  - development is in progress
- **Active project to expand standard to support mobility**
  - unified fixed/mobile operation

Standards: Critical in World Trade

- In telecommunications, standards are vital.
- Standards are at the forefront of world trade
  - World Trade Organization rules accelerating process
- March 19, 2003 - **COMMERCE UNVEILS PLAN TO REDUCE BARRIERS TO TRADE**

Standards Initiative Aims to Increase Competition in Global Marketplace

Commerce Secretary Don Evans today announced an eight-point Standards Initiative to help break down trade barriers. The initiative is in response to industry concerns that foreign standards and technical regulation issues are becoming among of the greatest challenges to expanding exports.

Global Standardization

2001 IEEE Conference on Standards and Innovation in Information Technology
Boulder, Colorado, USA, 3-5 October 2001
http://siit2001.org

GOVERNMENT ACTIVITY TO INCREASE BENEFITS FROM THE GLOBAL STANDARDS SYSTEM*

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In this paper, we review the factors influencing the evolution of the global standards system. We then discuss some of the approaches that governments have taken or are exploring in order to modify the system for the benefit of domestic and worldwide economic development. We use as an example an effort of the U.S. National Institute of Standards and Technology to encourage voluntary consensus standards for interoperable broadband wireless access systems.

Globalization of the economy has in turn led to globalization of standardization. Governments play a strong role in shaping the global standards system. They have explored many approaches to optimize the system to meet their economic and social needs. Governmental activity sometimes conflicts with the interests of other governments or of local industry. In this paper, we investigate some of these issues.

BWA/802.16 Interest within China

"IEEE 802.16a Broadband Wireless Access (BWA) Standard Development and Internet Application": conference sponsored by Chinese government (MII) on 24 August 2001 in Beijing "on the specific topic of whether to use 802.16a as the Chinese national standard for fixed broadband wireless access at 3.5 GHz"

IEEE 802.16 and Europe

- **ETSI: European Telecom Standards Institute**
- **ETSI HIPERACCESS**
  - **Above 11 GHz (business-oriented)**
  - **ETSI began first, but IEEE finished first**
  - **802.16 encouraged harmonization**
    - **not accepted by ETSI**
- **ETSI HIPERMAN**
  - **Below 11 GHz (residential/hotspot oriented)**
  - **IEEE began first**
  - **Good cooperation**
  - **It appears that HIPERMAN will be 802.16-compliant.**

WiMAX Forum

- "Worldwide Interoperability for Microwave Access"
- SAN JOSE, Calif., April 8, 2003 – Leading communications component and equipment companies have joined a non-profit corporation, WiMAX, to help promote and certify the compatibility and interoperability of broadband wireless access equipment... accelerate the introduction of … equipment into the marketplace that adheres to the IEEE 802.16 technical standard, **speeding up last-mile broadband deployment worldwide**.

Dept. of Commerce Connections

TA and NIST

- Encouraging broadband access deployment
- Standards as a trade issue
- Have coordinated with NIST's Division of Standards Services
- NIST's ITL has made technical contributions to IEEE 802.16
- Digital Freedom Initiative in Office of International Technology
  - Also working with U.S. Department of State

ITA

- Standards as a trade issue
- Have worked with Office of Telecommunications Technologies (esp. John Henry), and U.S. Foreign and Commercial Service (Beijing) to encourage adoption of 802.16 in China

NTIA

- Communicating on spectrum policy issues
- starting to work with Office of Spectrum Management in effort to move 802.16 into formal international standardization

Future Efforts

- Forge ahead with IEEE 802.16
  - Much to do
  - Good standards evolve (e.g. Ethernet since 1980)
- Push international adoption of standards
- Work to make IEEE 802 an important player in future networks
  - including Fourth Generation (4G) networks
- Possibly revive the National Wireless Electronic Systems Testbed (N-WEST) concept...

Do we still need N-WEST?

- Standards bodies need reliable data upon which to base decisions.
  - Such data is difficult to obtain.
  - Data from an advocate is not fully accepted.
- NIST's measurement expertise and independence make it a reliable and trusted source.
- The work will accelerate standardization and keep the results technically sound.
- A testbed will help advance wireless from technology to standards to compliance testing to interoperability, and on to the next generation.
- This will aid manufacturers and help put new technology to work for network users.
- Plus, this is novel and interesting technical work.

Conclusion

- IEEE 802.16 WirelessMAN standards are enabling a new generation of broadband access networks to power the U.S. economy.
- U.S. participation in IEEE 802.16 has given U.S. a strong position in the resulting world market.
- NIST participation initiated and accelerated the IEEE 802.16 process.
  - Provided the leadership the industry sought.
- NIST participation has pushed the international adoption of IEEE 802.16.